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On the Eclipse of Iapetus by Saturn and its Ring-System, on November 1–2, 1889. By A. Marth.

The inclination of the orbit of *Iapetus* to the plane of the ring being nearly 14°, while the orbits of the other satellites have inclinations of less than 1°, the rare eclipses of *Iapetus* by the ring-system offer the only chance of deciding several questions which may be settled with the help of observed eclipses. No such observation has ever yet been made. Favourably-placed observers ought, therefore, to take full advantage of the rare chance they may get on November 1. There will not be another such chance for at least the next sixteen years.

The geocentric differences of right ascension and declination between *Titan* and *Iapetus* and the centre of *Saturn* will be from October 24 to November 4.

	Titan.		*Iapetus.*	
Greenwich Noon.	α_6-A.	δ_6-D.	α_8-A.	δ_8-D.
	s	″	s	″
Oct. 24	+ 1·60	−24·5	−23·73	+28·6
25	+ 5·90	−14·5	−21·79	+28·3
26	+ 9·31	− 2·4	−19·72	+27 8
27	+11 26	+10·0	−17·53	+27·2
28	+11·39	+20·8	−15·24	+26·4
29	+ 9·64	+28·1	−12·85	+25·4
30	+ 6·29	+30·7	−10·38	+24·3
31	+ 1·88	+28·2	− 7·84	+23·0
Nov. 1	− 2·84	+21·1	− 5·25	+21·5
2	− 7·14	+10·8	− 2·62	+19·9
3	−10·37	− 1·3	+ 0·04	+18·1
4	−12·09	−13·1	+ 2·70	+16·3

These values show that, while the Earth is still on the south side of the plane of the orbit of *Titan*, it has already passed through the plane of the orbit of *Iapetus*, and is on the north side of that plane. Hence *Titan* and *Iapetus*, though both being north of the planet, move apparently in opposite directions, *Titan* being in front of the planet, or near inferior conjunction, while *Iapetus* is beyond the planet, or near superior conjunction. On October 31, at $10^{\text{h}}{\cdot}5$ G.M.T., *Titan* passes in the direction of the minor axis of the ring at a distance of 26″ to the north. On November 1, at $8^{\text{h}}{\cdot}0$ G.M.T., *Iapetus* encounters

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Titan, and passes at a distance of 3″. Not long after this conjunction, between 9^h and 10^h, *Iapetus* enters the shadow of the ring-system, from which it will emerge between 4^h and 5^h on November 2. As I am very desirous not to give more precise predictions which might be misleading, I will let interested readers judge for themselves by furnishing them with the data for constructing a diagram, which will show them the sources of uncertainty in predicting the times at a glance.

The section of the shadow, through which *Iapetus* has to pass, consists of a series of ellipses, corresponding to the outer and inner rims, A*a*, B*b*, C*c*, of the three rings, and to the outline of the ball. The heliocentric semi-axes of these ellipses, corresponding to various determinations of the dimensions of the rings and of the ball, are at the time of the eclipse:

	Major, Semi-axis.	Minor, Semi-axis.			Major, Semi-axis.	Minor, Semi-axis.	
A	20″·76	4″·03	W. Struve	*b*	13″·79	2″·67	W. S.
	20·33	3·94	Bessel		12·87	2·50	O. S.
a	18·25	3·54	W. S.	*c*	10·99	2·13	Bond
	18·16	3·52	O. Struve		10·76	2·09	O. S.
B	17·82	3·46	W. S.	ball	9·30	...	W. S.
	17·62	3·42	O. S.		8·22	8·00	Bessel

The computed heliocentric co-ordinates of *Iapetus*, referred to the axes of the ring, and corresponding to the lines when light from the satellite arrives at the Earth, are:

	h	″	″		h	″	″
Nov. 1	8 Gr.	−16·08	+3·32	Nov. 1	20 Gr.	+ 4·08	+0·45
	12	− 9·36	+2·37	2	0	+10·80	−0·50
	16	− 2·64	+1·41		4	+17·52	−1·46
	20	+ 4·08	+0·45		8	+24·23	−2·41

What corrections these values may require I am unable to suggest. If I were acquainted with the observations of the satellite made during the last opposition, and could determine the errors of the last ephemeris, I might get nearer the truth. But it is clear that as an error of 1″ in the heliocentric longitude of the satellite corresponds to an error of 36 minutes in the time, considerable uncertainty must attach to any predicted times, to which the other sources of doubt add their share.

When used with the necessary caution of making proper allowance for this uncertainty, the following times may serve as a guide in preparing for the observations to be made:

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	h				
Nov. 1	8·0	Gr. Iap. & Tit.			
	9·4	„	Disappearance	A	W. S.
	9·6	„	„	„	Bessel
	10·6	„	? Reappearance	*a*	W. S.
	10·9	„	D.	B	O. S.
	22·8	„	R. from shadow of ball		Bessel
	23·1	„	„ „		W. S.
	23·8	„	enters shadow of crape ring.		
Nov. 2	1·4	„	D.	*b*	W. S.
	3·2	„	? R.	B	O. S.
	3·5	„	D.	*a*	W. S.
	4·5	„	R.	A	Bessel
	4·7	„	„	„	W. S.

Will *Iapetus* be visible when Cassini's division *a*B is between the satellite and the Sun? What will be the effect of the shadow of the crape ring upon the appearance of the satellite?

Favourably-placed observers will have to answer such questions by their watching the satellite, and their time will be well spent in doing so.